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PANASONIC CT-20G7DF-1 SERVICE MANUAL

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ORDER NO. MTNC021096A1
B1

Service Manual

Color Television

Simplified

Simplified Manual (NA7DM)

Panasonic

Models	Chassis
CT-20G7DF-1	**DP391**
CT-20D12DF-1	**EP391**
CT-2017F-1	**DP391**

Important notice:

Since "-1" and non dash models have different PCB layouts and parts; When servicing any of these models please confirm the model number before starting service so the correct manual is used.

This supplement service manual is issued to **ADD** the models of the **NA7DM** family listed above to the simplified service manual order No. MTNC020515A1 (CT-20D12F). Included in this supplement service manual are unique characteristics and a complete parts list. Please file and use this simplified service manual together with the simplified service manual order No. MTNC020515A1 (CT-20D12F) and the main service manual order No. MTNC010305C1 (CT-32D11E).

"**WARNING!** This Service Manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this Service Manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**safety precautions**" and "**important safety notice**" in this main manual.

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Important safety notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent x-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety precautions

General guidelines

An **Isolation Transformer** should always be used during the servicing of a receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always replace protective devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this receiver is operating. Operation of the receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **handling the picture tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to x-ray radiation.

The **test picture tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against x-ray radiation as well as implosion. The magnetic shield limits the x-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **35kV** without causing x-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage current cold check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc.

If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage current hot check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson model 229, Sencore model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 0.5 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the receiver must be repaired and rechecked before it is returned to the customer.

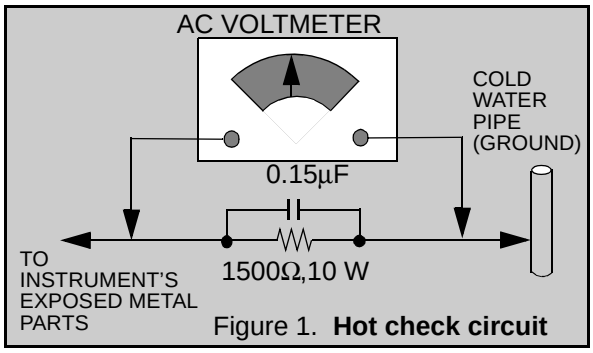

Figure 1. **Hot check circuit**

X-ray radiation

WARNING: The potential source of x-ray radiation in the TV set are the high voltage section and the picture tube.

Refer to **x-ray protecton circuit check** in service notes in this manual to confirm HHS voltage.

High voltage (CRT anode)

Confirm anode voltage is within limits:

Set the BRIGHTNESS, PICTURE, SHARPNESS and COLOR to minimum (to obtain a dark image). Measure high voltage. It should be:

26.60 ± 1.25kV.

If the upper limit is out of tolerance, immediate service and correction is required.

Note: *It is important to use an accurate, calibrated high voltage meter.*

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A-Board TNP2AH048DR 16

C-Board TNP2AA124AF. 21

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Service notes

Note: *These components are affixed with glue. Be careful not to break or damage any foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.*

Leadless chip component (surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

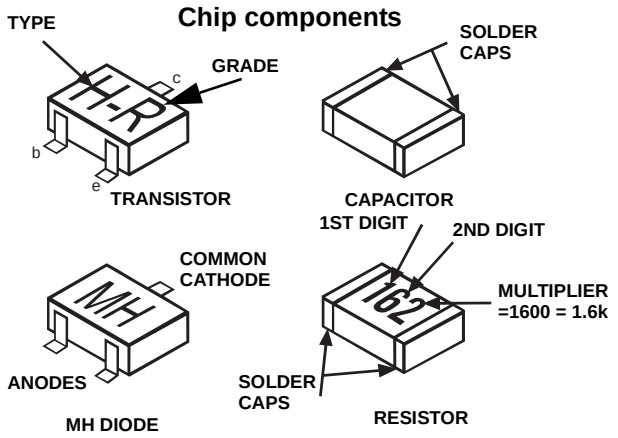
Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

Component removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip component Installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

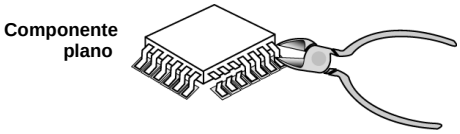


How to replace Flat-IC

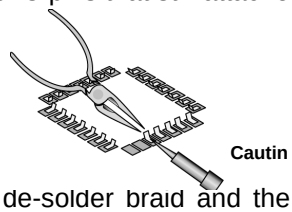
- Required tools -

- Soldering iron
- De-solder braids
- Sharpen pliers (wire cutters and long nose)
- Magnifier

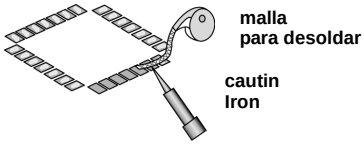
1. Cut the pins of the defective IC with the wire cutters pliers, and remove it completely away from the board. If the IC is glued to the board, apply hot air to complete the removal. **CAUTION**- Do not pull or twist the pliers, may damage the soldering pads in the board.



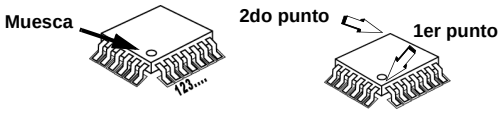
2. Using the soldering Iron and the long nose pliers, remove the IC pins that still attached to the board.



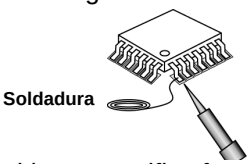
3. Using the de-solder braid and the soldering iron, remove the solder from the board soldering pads.



4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Start aligning and soldering pin no.1, then align and solder the pin in the apposite corner of the IC, this will help to align the rest of the pins.



5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.

Service notes (continued)

IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CTR DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This receiver has been designed to meet or exceed applicable safety and x-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to x-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

X-ray protection circuit check

This test must be performed as final check before the receiver is returned to the customer. If voltage is out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Equipment needed to check the protection circuit:

1. Isolator transformer.
2. High voltage meter.
3. Short jumper.
4. Diode connection jumper.
   Use similar diode than D823, refer to parts list for part No., (diode should support at least 150V.)

Procedure:

1. Connect receiver to isolator transformer.
2. Apply a monoscope pattern.
3. In service mode. (Refer to service mode section) select register C0B.
4. Measure TP5 (TPs port close to tuner). Compare the measure of TP5 and set the data for C0B according the following table

TP5 MEASURE (V)	DATA TO C0B (Hex)
0 ~ 0.93	00
0.93 ~ 0.97	01
0.97 ~ 1.01	02
1.01 ~ 1.05	03
1.05 ~ 1.09	04
1.09 ~ 1.13	05
1.13 ~ 1.17	06
1.17 ~ 1.21	07

5. Exit service mode and turn receiver OFF.
6. Connect a jumper from TPD16 to TPD17.
7. Connect the *diode jumper*, cathode to TPD14 (cold GND), anode to TPD15 (hot GND).

   Note: *Refer to Fig. 2 for test point location.*
8. Apply 75V AC to the AC input of the Insulator transformer.Turn receiver ON.
9. Set PICTURE and BRIGTHNESS to minimum.
10. Increase the AC voltage at the input of Insulator transformer and confirm the HHS voltage is **32.0kV,** at the point set starts to loose sync,
11. Reset picture controls to original levels.
12. Turn the set OFF, and remove all jumpers and connections from chassis.

Receiver feature table

FEATURE\MODEL	CT-20G7DF-1	CT-20D12DF-1	CT-2017F-1
Chassis No	DP391	EP391	DP391
Family	NA7DM		
Number of channels	181		
Menu language	ENG/SPAN/FR		
Closed Caption	X		
V-Chip (USA/CANADA)	X		
75 Ω input	X		
Remote Model number	EUR501450	EUR511502	EUR501450
Picture tube Supplier	SAMSUNG		
Comb Filter	2 DIG		
V/A norm	V		
MTS/SAP/DBX	X		
Built-in audio power	1.5Wx2 (10%)		
Number of speakers	2		
AI Sound	X		
A/V in (rear/front)	1(1/1)		
Audio Out (F:FAO/V:VAO)	---	F,V	----
S-VHS In (rear/front)	---	1/0	----
FM Radio	---	X	---
EPJ/HPJ/MISC	HPJ		
Dimensions mm (WxDxH) in	515.7x490.5x461.7 20.30x19.31x18.17		
Weight (kg/lbs)	18/39.6		
Anode voltage	26.60 ± 1.25 kV		
Video input jack	1Vp-p 75Ω, phono		
Audio input jack	500mV rms, 47KΩ		

Table 1. **Receiver features**

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Boards designation

MODELS	BOARD	PART NUMBER	BOARD DESCRIPTION
CT-2017F-1 **CT-20G7DF-1**	A-Board	TNP2AH048DR	MAIN BOARD
	C-Board	TNP2AA124AF	CRT BOARD

Table 1: **Boards designation**

Boards designation

MODELS	BOARD	PART NUMBER	BOARD DESCRIPTION
CT-20D12DF-1	A-Board	TNP2AH048DS	MAIN BOARD
	C-Board	TNP2AA124AF	CRT BOARD

Table 2: **Boards designation**

***Note:** When ordering a board, add and "S" after the board suffix application. Example, If order A-Board for* **CT-2017F-1**, *should be ordered as:* ***TNP2AH048DRS**.*

Important notice:

Since "-1" and non dash models have different PCB layouts and parts; When servicing any of these models please confirm the model number before starting service so the correct manual is used.

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
	CAPACITORS	
C001	**TCJ2VB1H103K**	**CAP,C .01UF-K-50V**
C002	TCJ2VB1H471K	CAP,C 470PF-K-50V
C003	ECA1HM4R7B	CAP,E 4.7UF-50V
C004	TCJ2VC1H150J	CAP,C 15PF-J-50V
C005	TCJ2VC1H150J	CAP,C 15PF-J-50V
C008	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C009	ECA1AM470B	CAP,E 47UF-10V
C010	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C011	ECA1AM101B	CAP,E 100UF-10V
C015	ECJ2VB1C224K	CAP,C .22UF-K-16V
C016	TCJ2VC1H101J	CAP,C 100PF-J-50V
C017	TCJ2VB1C104K	CAP,C .1UF-K-16V
C018	TCJ2VC1H151J	CAP,C 150PF-J-50V
C020	TCJ2VB1C104K	CAP,C .1UF-K-16V
C022	TCJ2VC1H101J	CAP,C 100PF-J-50V
C023	TCJ2VC1H151J	CAP,C 150PF-J-50V
C024	ECA1AM470B	CAP,E 47UF-10V
C025	TCJ2VB1C104K	CAP,C .1UF-K-16V
C026	TCJ2VB1C104K	CAP,C .1UF-K-16V
C027	TCJ2VC1H391J	CAP,C 390PF-J-50V
C028	TCJ2VB1C104K	CAP,C .1UF-K-16V
C029	ECQB1H333JF3	CAP,P .033UF-J-50V
C031	ECA1HMR22B	CAP,E .22UF-50V
C032	ECA1AM470B	CAP,E 47UF-10V
C033	TCJ2VC1H390J	CAP,C 39PF-J-50V
C034	TCJ2VB1H103K	CAP,C .01UF-K-50V
C035	ECA1HM010B	CAP,E 1UF-50V
C036	TCJ2VB1H103K	CAP,C .01UF-K-50V
C037	ECA1HM0R1B	CAP,E 0.1UF/50V
C038	ECA1AM470B	CAP,E 47UF-10V
C040	ECA1AM470B	CAP,E 47UF-10V
C041	ECA1HM2R2B	CAP,E 2.2UF-50V
C042	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C043	ECA1AM470B	CAP,E 47UF-10V
C044	TCJ2VC1H471J	CAP,C 470PF-J-50V
C045	ECA1HM0R1B	CAP,E 0.1UF/50V
C046	TCJ2VB1C104K	CAP,C .1UF-K-16V
C047	TCJ2VC1H220J	CAP,C 22PF-J-50V
C048	TCJ2VC1H220J	CAP,C 22PF-J-50V
C050	ECA1AM101B	CAP,E 100UF-10V
C051	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C054	TCJ2VB1H103K	CAP,C .01UF-K-50V *CT-20D12DF-1*
C055	TCJ2VC1H560J	CAP,C 56PF-J-50V
C057	TCJ2VC1H471J	CAP,C 470PF-J-50V *CT-20D12DF-1*
C103	ECA0JM331B	CAP,E 330UF-6.3V
C104	TCJ2VB1H103K	CAP,C .01UF-K-50V
C105	ECA0JM101B	CAP,E 100UF-6.3V
C350	ECA1CM101B	CAP,E 100UF/16V

REF NO.	PART NO.	DESCRIPTION
C351	TCJ2VB1H391K	CAP,C 390PF-K-50V
C352	TCJ2VB1H391K	CAP,C 390PF-K-50V
C353	TCJ2VB1H471K	CAP,C 470PF-K-50V
C354	ECKW3D102KBN	CAP,C .001UF-K-2KVDC
C357	EEANA1E1R0B	CAP,E 1.0UF-25V
C361	TCJ2VC1H151J	CAP,C 150PF-J-50V
C362	TCJ2VC1H151J	CAP,C 150PF-J-50V
C363	TCJ2VC1H151J	CAP,C 150PF-J-50V
C451	ECA1CHG470B	CAP,E 47UF-16V
C452	ECSF1EE105VB	CAP,E 1.0UF-25V
C453	ECEA1HFS2R2B	CAP,E 2.2UF-50V
C454	ECA1EM102E	CAP,E 1000UF-25V
C455	ECA1EHG101B	CAP,E 100UF-25V
C456	ECQB1H103JF3	CAP,P .01UF-J-50V
C459	ECA1VHG471B	CAP,E 470UF-35V
C462	ECA1HM4R7B	CAP,E 4.7UF-50V
C502	TCJ2VC1H471J	CAP,C 470PF-J-50V
C503	TCJ2VB1C104K	CAP,C .1UF-K-16V
C504	TCJ2VB1C104K	CAP,C .1UF-K-16V
C510	ECCR2H100D5	CAP,C 10PF-D-500V
C511	ECKR2H821KB5	CAP,C 820PF-K-500V
C512	ECKR2H101KB5	CAP,C 100UF-K-500V
C530	TCJ2VF1H473Z	CAP,C .047UF-Z-50V
C531	**ECA1EM220B**	**CAP,E 22UF-25V**
C551	**ECA1VM331B**	**CAP,E 330UF-35V**
C554	ECKR2H561KB5	CAP,C 560PF-K-500V
C555	**ECA2EM220E**	**CAP,E 22UF-250V**
C556	**ECA1CM471B**	**CAP,E 470UF-16V**
C557	ECKR2H222KB5	CAP,C 2200PF-K-500V
C558	ECA1HM4R7B	CAP,E 4.7UF-50V
C560	**EEANA1E2R2B**	**CAP,E 2.2UF-25V**
C561	ECKR2H561KB5	CAP,C 560PF-K-500V
C562	ECA1EM220B	CAP,E 22UF-25V
C563	**ECWH12H362JS**	**CAP,P 3600PF-J-1250VDC**
C564	**ECWH12H562JS**	**CAP,P .0056UF-J-1.2KV**
C565	**ECKW3D331JBR**	**CAP,C 330PF-J-2KV**
C566	**ECKW3D181JBP**	**CAP,C 180PF-J-2KV**
C568	**ECQM4473JZW**	**CAP,P .047UF-J-400V**
C569	**ECWF2394JBB**	**CAP,P .39UF-J-200V**
C570	ECA1CM222E	CAP,E 2200UF-16V
C571	ECA1EM220B	CAP,E 22UF-25V
C572	ECA1CM100B	CAP,E 10UF-16V
C573	ECA1CM101B	CAP,E 100UF/16V
C575	ECA0JM222B	CAP,E 2200UF-6.3V
C577	ECA1CM101B	CAP,E 100UF/16V
C578	ECA0JM332B	CAP,E 3300PF-6.3V
C579	TCJ2VC1H100D	CAP,C 10PF-J-50V
C580	TCJ2VB1H152K	CAP,C 1500PF-K-50V
C605	TCJ2VB1H103K	CAP,C .01UF-K-50V
C606	ECA0JM221B	CAP,E 220UF-6.3V

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C800	ECKR3A391KBP	CAP,C 390PF-K-1KVDC
C801	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C802	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C803	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C805	**EC0S2DA221BB**	**CAP,E 220UF/200V**
C806	ECQM4103KZW	CAP,P .01UF-K-400V
C807	ECKR3A821KBP	CAP,C 820PF-K-1KV
C808	ECA1VM101B	CAP,E 100UF-35V
C809	ECKR1H101KB5	CAP,C 100PF-K-50V
C810	ECKR1H471KB5	CAP,C 470PF-K-50V
C812	**ECQU2A224MVA**	**CAP,P .22UF-M-250VAC**
C813	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C814	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C820	ECA1CM101B	CAP,E 100UF/16V
C821	TCJ2VB1H103K	CAP,C .01UF-K-50V
C822	ECKR3A221KBP	CAP,C 220PF-K-1KV
C823	**ECA1VM471E**	**CAP,E 470UF-35V**
C824	ECKR3A102KBP	CAP,C 1000PF-K-1KV
C825	**EEUMG2C221S**	**CAP,E 220UF-160V**
C826	ECKR3A471KBP	CAP,C 470PF-K-1KV
C827	ECA1CM471B	CAP,E 470UF-16V
C828	**ECA160V33UE**	**CAP,E 33UF/160V**
C840	ECQB1H224JF3	CAP,P .22UF-J-50V
C2201	ECA1HM4R7B	CAP,E 4.7UF-50V
C2202	ECA1HM2R2B	CAP,E 2.2UF-50V
C2203	ECA1HM4R7B	CAP,E 4.7UF-50V
C2204	AP106K016CAE	CAP,T 10UF/16V
C2205	ECA1HMR33B	CAP,E .33UF-50V
C2206	ECQB1H223JF3	CAP,P .022UF-J-50V
C2207	AP335K016CAE	CAP,T 3.3UF/16V
C2208	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2209	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2210	TCJ2VB1C104K	CAP,C .1UF-K-16V
C2212	ECQB1H473JF3	CAP,P .047UF-J-50V
C2213	ECA1HMR47B	CAP,E .47UF-50V
C2214	ECA1AM101B	CAP,E 100UF-10V
C2215	EEANA1E100B	CAP,E 10UF-25V
C2216	TCJ2VC1H100D	CAP,C 10PF-J-50V
C2301	ECA1EM102E	CAP,E 1000UF-25V
C2302	ECEA1HN010UB	CAP,E 1UF/50V
C2303	ECA1EM101B	CAP,E 100UF-25V
C2304	ECA1CM100B	CAP,E 10UF-16V
C2307	ECA1CM102B	CAP,E 1000UF/16V
C2309	ECA1HM010B	CAP,E 1UF-50V *CT-20D12DF-1*
C2311	ECA1EM102E	CAP,E 1000UF-25V
C2312	ECEA1HN010UB	CAP,E 1UF/50V
C2313	ECA1EM101B	CAP,E 100UF-25V
C2314	ECA1CM100B	CAP,E 10UF-16V
C2317	ECA1CM102B	CAP,E 1000UF/16V
C2319	ECA1HM010B	CAP,E 1UF-50V *CT-20D12DF-1*

REF NO.	PART NO.	DESCRIPTION
C2320	ECA1CM100B	CAP,E 10UF-16V
C2330	ECA1CM100B	CAP,E 10UF-16V
C2350	ECA1HM100B	CAP,E 10UF/50V
C3001	ECA1HM0R1B	CAP,E 0.1UF/50V
C3012	ECA1HM010B	CAP,E 1UF-50V
C3018	ECA1HM010B	CAP,E 1UF-50V
C3050	TCJ2VB1H103K	CAP,C .01UF-K-50V *CT-20D12DF-1*
C3051	TCJ2VB1H103K	CAP,C .01UF-K-50V *CT-20D12DF-1*
	DIODES	
D002	MA2C165001VT	DIODE
D006	MAZ43300HF	DIODE, ZENER
D052	MAZ40680MF	DIODE, ZENER
D053	MAZ40560MF	DIODE, ZENER
D055	MAZ40560MF	DIODE, ZENER
D451	B0EAKL000008	DIODE, RECTIFIER
D452	MAZ40470MF	DIODE, ZENER
D453	MA2C165001VT	DIODE
D454	MA2C165001VT	DIODE
D456	MAZ40470MF	DIODE, ZENER
D502	MAZ40470MF	DIODE, ZENER
D531	**B0HAHP000008**	**DIODE**
D551	**B0HAMM000072**	**DIODE, FAST RECOVERY**
D554	**AU02V0**	**DIODE**
D556	MA2C165001VT	DIODE
D558	B0HANV000008	DIODE
D559	BYD33G-113	DIODE
D561	**AU02V0**	**DIODE**
D606	MA2C165001VT	DIODE
D607	MA3X152K0L	DIODE
D608	MA3X152K0L	DIODE
D609	MA3X152K0L	DIODE
D801	**D3SBA60-4103**	**DIODE**
D806	**TAP2AA0001**	**PTC 5-OHM**
D808	SARS01V1	DIODE
D809	B0HAJP000015	DIODE
D810	B0HAJP000015	DIODE
D811	B0HAJP000015	DIODE
D812	**MAZ40680MF**	**DIODE, ZENER**
D820	MA2C165001VT	DIODE
D821	MAZ40470HF	DIODE, ZENER
D822	B0HAMM000103	DIODE
D823	**S3L60P154004**	**DIODE**
D824	B0HAMM000072	DIODE, FAST RECOVERY
D2305	MAZ31100ML	DIODE, ZENER *CT-20D12DF-1*
D2306	MAZ31100ML	DIODE, ZENER *CT-20D12DF-1*
D2307	MAZ31100ML	DIODE, ZENER *CT-20D12DF-1*
D2308	MAZ31100ML	DIODE, ZENER *CT-20D12DF-1*
D2350	MAZ40680MF	DIODE, ZENER
D2351	MA2C165001VT	DIODE

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
D2352	MA2C165001VT	DIODE
D2353	MA2C165001VT	DIODE
D2354	MAZ40910MF	DIODE, ZENER
D3001	MAZ31100ML	DIODE, ZENER
D3003	MAZ31100ML	DIODE, ZENER
D3004	MAZ31100ML	DIODE, ZENER
D3005	MAZ31100ML	DIODE, ZENER
D3006	MAZ31100ML	DIODE, ZENER
D3017	MAZ31100ML	DIODE, ZENER
D3018	MAZ31100ML	DIODE, ZENER
D3019	MAZ31100ML	DIODE, ZENER
D3020	MAZ31100ML	DIODE, ZENER
D3021	MAZ31100ML	DIODE, ZENER
D3022	MAZ31100ML	DIODE, ZENER
	FUSES	
F801	**XBA2A00101**	**FUSE 6.3A 125V**
	INTEGRATED CIRCUITS	
IC001	**M65584MA-104**	**MPU/VCJ**
IC002	TVR2AJ149S	EEPROM
IC003	PIC-37042SR	IR RECEIVER
IC005	PQ1X331M2ZP	VOLTAGE REGULATOR, 3.3V
IC006	MN1280R	RESET
IC451	**LA7837-TV**	**V OUT**
IC551	AN78L09	VOLTAGE REGULATOR 9V *CT-20D12DF-1*
IC551	AN78M09LB	VOLTAGE REGULATOR 9V *CT-20G7DF-1*, *CT-2017F-1*
IC552	**AN78M05LB**	**VOLTAGE REGULATOR PLUS 5V AVR**
IC553	**AN78M05LB**	**VOLTAGE REGULATOR PLUS 5V AVR**
IC801	**STRG5623A**	**POWER SUPPLY, 360V**
IC2201	AN5829S-E1V	MTS, S-AGC
IC2301	AN17800A	AUDIO AMP *CT-2017F-,1, CT-20G7DF-1*
IC2301	AN17801A	AUDIO AMP *CT-20D12DF-1*
IC2302	AN17800A	AUDIO AMP *CT-2017F-,1, CT-20G7DF-1*
IC2302	AN17801A	AUDIO AMP *CT-20D12DF-1*
	COILS	
L001	EXCELSA35T	FERRITE BEAD
L003	TLUABTA6R8K	COIL, 6.8UH
L004	TLUABTA6R8K	COIL, 6.8UH
L005	EXCELDR35V	FERRITE BEAD
L006	EXCELSA24T	FERRITE BEAD
L007	EXCELDR35V	FERRITE BEAD
L008	G0C470KA0029	COIL, PEAKING 47UH
L009	EXCELSA35V	FERRITE BEAD
L010	ELESN330JA	COIL, PEAKING 33UH
L011	ELESN330JA	COIL, PEAKING 33UH
L013	EXCELDR35V	FERRITE BEAD
L014	ELESN180KA	COIL, PEAKING 18UH

REF NO.	PART NO.	DESCRIPTION
L015	EXCELSA35V	FERRITE BEAD
L016	EXCELSA35V	FERRITE BEAD
L017	G0C100KA0029	COIL, PEAKING 10UH
L019	EXCELDR35V	FERRITE BEAD
L021	G0C470KA0029	COIL, PEAKING 47UH
L022	EXCELSA39V	FERRITE BEAD
L090	EXCELSA24T	FERRITE BEAD
L104	G0C2R2KA0029	COIL, PEAKING 2.2UH
L108	EXCELSA35V	FERRITE BEAD
L245	EXCELSA35V	FERRITE BEAD
L250	EXCELSA35V	FERRITE BEAD
L306	G0C2R2KA0029	COIL, PEAKING 2.2UH
L325	EXCELSA35V	FERRITE BEAD
L403	G0C2R2KA0029	COIL, PEAKING 2.2UH
L416	EXCELSA39V	FERRITE BEAD
L551	**ELH5L4101**	**COIL**
L801	**ELF15N011A**	**LINE FILTER**
L802	ELEKE680KA	COL, PEAKING 68UH
L803	TALL08T680KA	COIL
L807	EXCELSA35V	FERRITE BEAD
L808	EXCELSA35V	FERRITE BEAD
L2305	EXCELSA35V	FERRITE BEAD
L2308	EXCELSA24V	FERRITE BEAD
L2350	ELESN4R7JA	COIL, PEAKING 4.7UH
	TRANSISTORS	
Q001	2SD601ARTX	TRANSISTOR
Q006	2SB709ARTX	TRANSISTOR
Q007	2SB709ARTX	TRANSISTOR
Q008	2SB709ARTX	TRANSISTOR
Q009	2SC1473A	TRANSISTOR
Q090	2SB709ARTX	TRANSISTOR
Q092	2SB709ARTX	TRANSISTOR
Q351	2SC3063RL	TRANSISTOR
Q352	2SC3063RL	TRANSISTOR
Q353	2SC3063RL	TRANSISTOR
Q354	2SD601ARTX	TRANSISTOR
Q355	2SD601ARTX	TRANSISTOR
Q356	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q453	2SD601ARTX	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q505	2SD601ARTX	TRANSISTOR
Q520	2SD601ARTX	TRANSISTOR
Q551	**2SC562200VLA**	**TRANSISTOR**
Q605	2SB709ARTX	TRANSISTOR
Q606	2SD601ARTX	TRANSISTOR
Q820	2SA1767QTA	TRANSISTOR
Q830	2SB1011QRL	TRANSISTOR
Q2350	2SB709ARTX	TRANSISTOR

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

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REF NO.	PART NO.	DESCRIPTION
	RELAYS	
RL801	**K6B1AGA00042**	**RELAY**
	RESISTORS	
R001	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R003	ERJ6GEYJ105V	RES,M 1M-J-1/10W
R004	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R006	ERDS2TJ101T	RES,C 100-J-1/4W
R007	ERJ6GEYJ471V	RES,M 470-J-1/10W
R008	ERJ6GEYJ471V	RES,M 470-J-1/10W
R009	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R010	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R012	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R013	ERJ6GEYJ202V	RES,M 2K-J-1/10W
R014	ERJ6GEYJ221V	RES,M 220-J-1/10W
R015	ERJ6GEYJ221V	RES,M 220-J-1/10W
R016	ERJ6GEYJ221V	RES,M 220-J-1/10W
R017	ERJ6GEYJ681V	RES,M 680-J-1/10W
R018	ERJ6GEYJ681V	RES,M 680-J-1/10W
R019	ERJ6GEYJ681V	RES,M 680-J-1/10W
R021	ERJ6GEYJ101V	RES,M 100-J-1/10W
R022	ERJ6GEYJ101V	RES,M 100-J-1/10W
R023	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R024	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R028	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R029	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R032	ERJ6ENF1002V	RES,M 10K-F-1/10W
R033	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R034	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R035	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R036	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R037	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R038	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R039	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R040	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R041	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R042	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R043	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20D12DF-1*
R044	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20G7DF-1*, *CT-2017F-1*
R044	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W *CT-20D12DF-1*
R045	ERJ6GEYJ101V	RES,M 100-J-1/10W
R046	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R077	ERJ6GEYJ103V	RES,M 10K-J-1/10W *CT-20D12DF-1*
R078	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R081	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R090	ERJ6GEYJ471V	RES,M 470-J-1/10W
R091	ERJ6GEYJ185V	RES,M 1.8MEG-J-1/10W

REF NO.	PART NO.	DESCRIPTION
R092	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R093	ERJ6GEYJ331V	RES,M 330-J-1/10W
R201	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W *CT-20D12DF-1*
R202	ERJ6GEYJ102V	RES,M 1K-J-1/10W *CT-20D12DF-1*
R202	ERJ6GEYJ751V	RES,M 750-J-1/10W *CT-20G7DF-1*, *CT-2017F-1*
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R355	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R356	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R357	ERJ6ENF4300V	RES,M 430-F-1/10W
R358	ERJ6ENF4300V	RES,M 430-F-1/10W
R359	ERJ6ENF4300V	RES,M 430-F-1/10W
R360	ERJ6ENF7500V	RES,M 750-F-1/10W
R361	ERJ6ENF7500V	RES,M 750-F-1/10W
R362	ERJ6ENF7500V	RES,M 750-F-1/10W
R363	ERJ6GEYJ101V	RES,M 100-J-1/10W
R364	ERJ6GEYJ101V	RES,M 100-J-1/10W
R365	ERJ6GEYJ101V	RES,M 100-J-1/10W
R370	ERDS2TJ224T	RES,C 220K-J-1/4W
R381	ERJ6GEYJ101V	RES,M 100-J-1/10W
R382	ERJ6GEYJ101V	RES,M 100-J-1/10W
R383	ERJ6GEYJ101V	RES,M 100-J-1/10W
R384	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R385	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R386	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R387	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R388	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R389	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R390	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R391	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R392	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R450	ERJ6GEYJ563V	RES,M 56K-J-1/10W
R451	ERDS1FJ1R2P	RES,C 1.2-J-1/2W
R454	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R455	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R456	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R457	ERJ6GEYJ152V	RES,M 1.5K-J-1/10W
R458	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R459	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R460	ERDS2TJ102T	RES,C 1K-J-1/4W
R462	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R463	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R465	ERJ6GEYJ303V	RES,M 30K-J-1/10W
R467	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R468	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R469	ERJ6GEYJ220V	RES,M 22-J-1/10W

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

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REF NO.	PART NO.	DESCRIPTION
R470	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R471	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R472	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R475	ERJ6GEYJ471V	RES,M 470-J-1/10W
R502	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R504	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R505	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R506	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R507	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R508	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R510	**ERG3FJ272**	**RES,M 2.7K-J-3W**
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R520	ERJ6GEYJ471V	RES,M 470-J-1/10W
R521	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R531	**ERD25FJ470P**	**RES,C 47-J-1/4W**
R532	**ERJ6ENF8871V**	**RES,M 8.87K-F-1/10W**
R533	**ERJ6ENF1301V**	**RES,M 1.3K-F-1/10W**
R551	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R552	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R555	**ERDS1FJ101T**	**RES,C 100-J-1/2W**
R556	ERG1SJ221P	RES,M 220-J-1W
R557	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R558	**ERQ2CJP2R2S**	**RES,F 2.2-J-2W**
R559	ERG2FJ683H	RES,M 12K-J-2W
R562	ERG3FJ680H	RES,M 68-J-3W
R563	ERG1SJ150P	RES,M 15-J-1W
R564	ERDS2TJ104T	RES,C 100K-J-1/4W
R565	ERDS2TJ124T	RES,C 120K-J-1/4W
R566	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R567	ERG2FJ122H	RES,M 12K-J-2W
R568	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R571	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R605	ERDS2TJ103T	RES,C 10K-J-1/4W
R606	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R607	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R608	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R802	ERDS2TJ684T	RES,C 680K-J-1/4W
R803	ERG2FJ100H	RES,M 10K-J-1/2W
R804	ERG2FJ104H	RES,M 100K-J-2W
R805	**ERX2FZJR18H**	**RES,M .18-J-2W**
R806	**ERX2FJR56H**	**RES,M .56-J-2W**
R807	ERDS2TJ681T	RES,C 680-J-1/4W
R808	ERDS2TJ4R7T	RES,C 4.7-J-1/4W
R809	ERDS2TJ472T	RES,C 4.7K-J-1/4
R815	**ERC12ZGM825D**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ6R8**	**RES,F 6.8-J-3W**
R821	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R822	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R823	ERDS1FJ272T	RES,C 2.7K-J-1/2W

REF NO.	PART NO.	DESCRIPTION
R824	ERDS2TJ223T	RES,C 22K-J-1/4W
R825	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R828	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R830	ERDS2TJ104T	RES,C 100K-J-1/4W
R831	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R850	**ERQ12HJR56P**	**RES,F .56-J-1/2W**
R2201	ERJ6GEYJ224V	RES,M 220K-J-1/10W
R2203	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R2204	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R2205	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2206	ERJ6GEYJ273V	RES,M 27K-J-1/10W
R2301	ERQ2CJP3R9S	RES,F 3.9-J-2W
R2307	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2320	ERJ6GEYJ104V	RES,M 100K-J-1/10W *CT-20D12DF-1*
R2350	ERDS2TJ391T	RES,C 390-J-1/4W
R2351	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R2352	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R2353	ERJ6GEYJ124V	RES,M 120K-J-1/10W
R2354	ERJ6GEYJ123V	RES,M 12K-J-1/10W
R2355	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R2356	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2357	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2365	ERDS2TJ102T	RES,C 1K-J-1/4W
R2370	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2417	ERJ6GEYJ104V	RES,M 100K-J-1/10W *CT-20D12DF-1*
R3001	ERDS2TJ101T	RES,C 100-J-1/4W
R3005	ERJ6GEYJ334V	RES,M 330K-J-1/10W
R3007	ERJ6GEYJ151V	RES,M 150-J-1/10W
R3008	ERJ6GEYJ151V	RES,M 150-J-1/10W
R3009	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3010	ERJ6GEYJ334V	RES,M 330K-J-1/10W
R3011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3013	ERJ6ENF75R0V	RES,M 75.0-F-1/10W *CT-20D12DF-1*
R3014	ERJ6ENF75R0V	RES,M 75.0-F-1/10W *CT-20D12DF-1*
R3016	ERDS2TJ181T	RES,C 180-J-1/4W
R3017	ERDS2TJ181T	RES,C 180-J-1/4W
R3018	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3019	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3050	ERJ6GEYJ101V	RES,M 100-J-1/10W *CT-20D12DF-1*
R3051	ERJ6GEYJ101V	RES,M 100-J-1/10W *CT-20D12DF-1*
SWITCHES		
S001	EVQPF106K	SWITCH
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH

REPLACEMENT PARTS LIST

Models: CT-20G7DF-1, CT-20D12DF-1, CT-2017F-1

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
S008	EVQPF106K	SWITCH
S009	EVQPF106K	SWITCH
	TRANSFORMERS	
T501	**ETH19Y211AZ**	**TRANSFORMER**
T551	**KFT3AA341F**	**TRANSFORMER, FLYBACK**
T801	**ETS29AS183NC**	**TRANSFORMER**
	CRYSTALS/FILTERS	
X001	TSSA092	CRYSTAL OSCILLATOR
X002	AF080005BE	CRYSTAL
	OTHERS	
TNR001	**ENG36604GR**	**TUNER** ***CT-2017F-,1, CT-20G7DF-1***
TNR001	**ENG36610G**	**TUNER** ***CT-20D12DF-1***
M001	**TSX2AA0111-1**	**LINE CORD (SPT2)**
M002	**A51KRE89XDT**	**CRT 20"**
M003	**TJSC00300**	**CRT SOCKET**
M004	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M005	JH291U-009	YOKE, CONVERGENCE
DY	**TLY2AA001**	**DEFLECTION YOKE**
M006	TMM2A30702	WEDGE, YOKE
M007	TXF3A011DB2	ASSY. DAG GROUND
DEG	**TSP2AA008**	**COIL, DEGAUSSING 20 INCH**
M008	TSN63115-4	MAGNET, PURITY
M009	TAS2AA0012	SPEAKER 16-OHM 1.5W
M010	TXFKU05ESER	ASSY, CABINET BACK *CT-20G7DF-1*
M011	TXFKU06BSER	ASSY, CABINET BACK *CT-2017F-1*
M012	TXFKU06ESER	ASSY, CABINET BACK *CT-20D12DF-1*

REF NO.	PART NO.	DESCRIPTION
M013	TBM2A10141	BADGE, PANASONIC
M014	TBX2AA0121	BUTTON, 7-KEY *CT-20G7DF-1 CT-20D12DF-1*
M015	TBX2AA1701GS	BUTTOM, 7-KEY *CT-2017F-1*
M016	TKX2AA00401	IR GUIDE *CT-2017F-1*
M017	TKX2AA00404	IR GUIDE *CT-20G7DF-1 CT-20D12DF-1*
M018	TXFKY06ESER	ASSY, CABINET FRONT *CT-2017F-1*
M019	TXFKY09FSER	ASSY, CABINET FORNT *CT-20G7DF-1*, *CT-20D12DF-1*
JK3001	TJB2A9063B	ASSY. JACK 1A/V *CT-20D12DF-1*
JK3001	TJB2A9064B	ASSY. JACK A/V *CT-2017F-,1, CT-20G7DF-1*
JK3002	TJB2AA0046	TERMINAL, FRONT A/V
JK3003	TJB2AA0171	TERMINAL, S-VHS *CT-20D12DF-1*
	ACCESORIES	
M020	EUR501450	REMOTE CONTROL *CT-20G7DF-1, CT-2017F-1*
M021	EUR511502	REMOTE CONTROL *CT-20D12DF-1*
M022	UR50EC1190A	BATTERY COVER, REMOTE CONTROL *CT-2017F-,1, CT-20G7DF-1*
M023	UR51EC975A	BATTERY COVER, REMOTE CONTROL *CT-20D12DF-1*
M024	TQB2AA0370-2	OWNERS MANUAL *CT-2017F-1*
M025	TQB2AA0431-2	OWNERS MANUAL *CT-20G7DF-1*, *CT-20D12DF-1*

DESCRIPTION OF ABBREVIATIONS GUIDE

RESISTOR

TYPE		TOLERANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

RES, C 270-J-1/4

CAPACITOR

TYPE		TOLERANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
		L	± 15%
		M	± 20%
		P	+10% -0%
		Z	+80% -20%

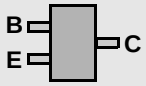
CAP, P .068UF-K-50V

Notes

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION



SCHEMATIC NOTES

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in μH.
4. Test point indicated by ; Test point but no pin .
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol indicates **HOT GROUND CONNECTION**; indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

VOLTAGE MEASUREMENTS

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol indicates ground lead connection of meter.
   Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

WAVEFORM MEASUREMENTS

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to “MIN”.
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

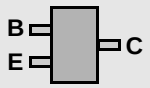
CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Notas:

NOTA DE SEGURIDAD

LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍSTICAS ESPECIALES MUY IMPORTANTES PARA LA PROTECCIÓN CONTRA RAYOS-X, QUEMADURAS Y DESCARGAS ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTANTE USAR PARA REEMPLAZO DE COMPONENTES CRITICOS, SOLO PARTES ESPECIFICADAS POR EL FABRICANTES. LOS COMPONENTES CRITICOS ESTAN SEÑALADOS EN LOS DIAGRAMAS POR EL SIMBOLO ⚠.

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



NOTAS DE LOS DIAGRAMAS

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en μH.
4. Los puntos de prueba en la terminal de algún componente son indicados por ⏽ Los puntos de prueba fuera de los componentes se indican con ⏽.
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

MEDICIÓN DE VOLTAJES

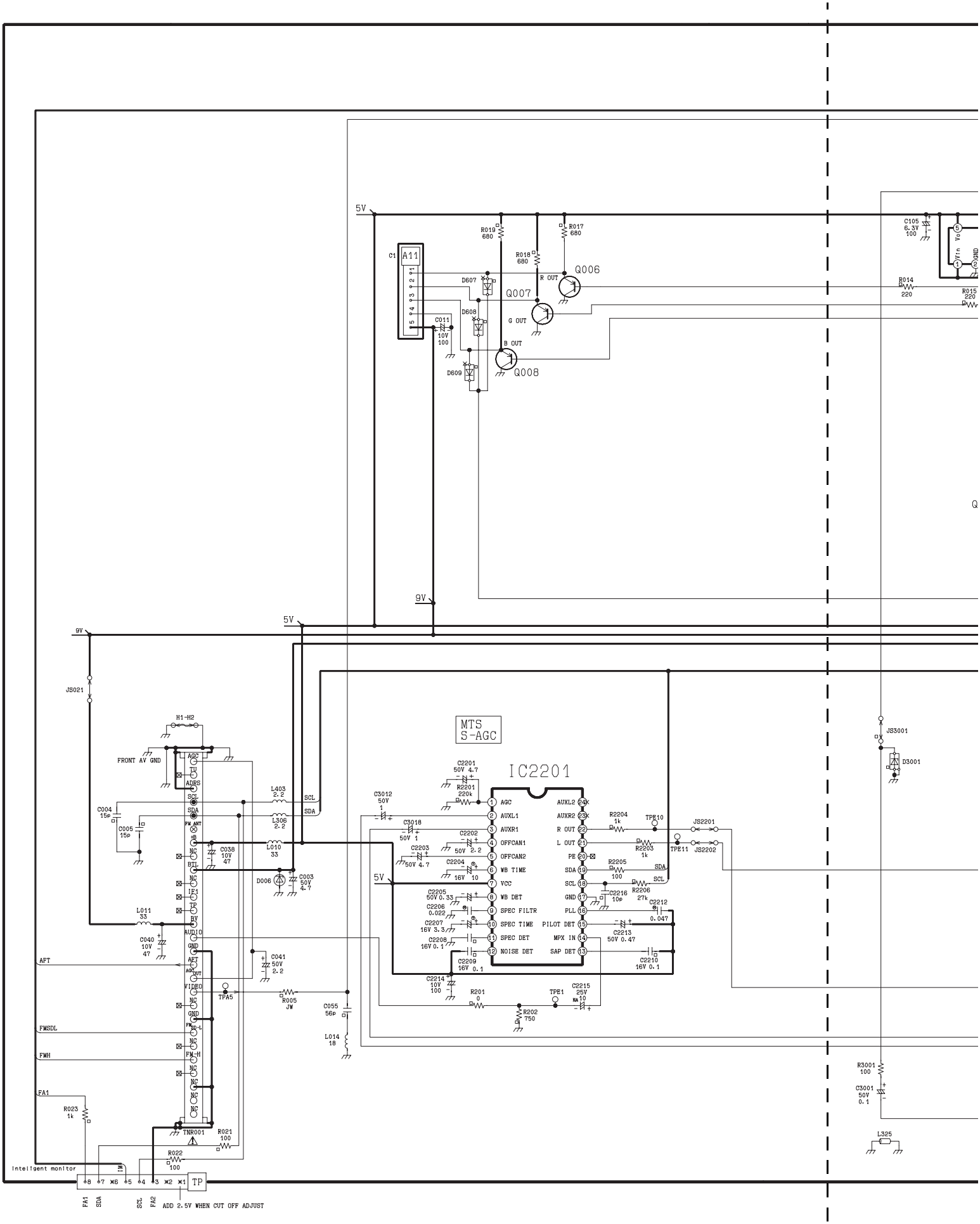
1. Medición de voltaje:
   - El voltaje de entrada al Receptor es de 120V de Corriente Alterna. Un generador de patrones con formato NTSC se conecta a la entrada de la antena. (Patrón de Barras de Colores con 100 IREs para el Blanco y 7.5 IREs para el Negro.)
   - Los ajustes de los Menus Picture y Audio se normalizan.
     En el Menú Set-Up, en la opción ANTENA, se selecciona el modo de CABLE.
     El nivel de Volumen se minimiza.
     De los modos TV y Video, seleccionar el modo TV.
     Seleccionar modo Estereo del Audio.
   - Las mediciones de los voltajes son nominales y pueden variar hasta 10% en componentes en funcionamiento. Las lecturas de los voltajes pueden variar por la potencia de la señal y el contenido de la imagen.
   - Las fuentes de voltajes son nominales.
2. El símbolo ⏚ indica el tipo de tierra que se utiliza en la conexión del medidor.

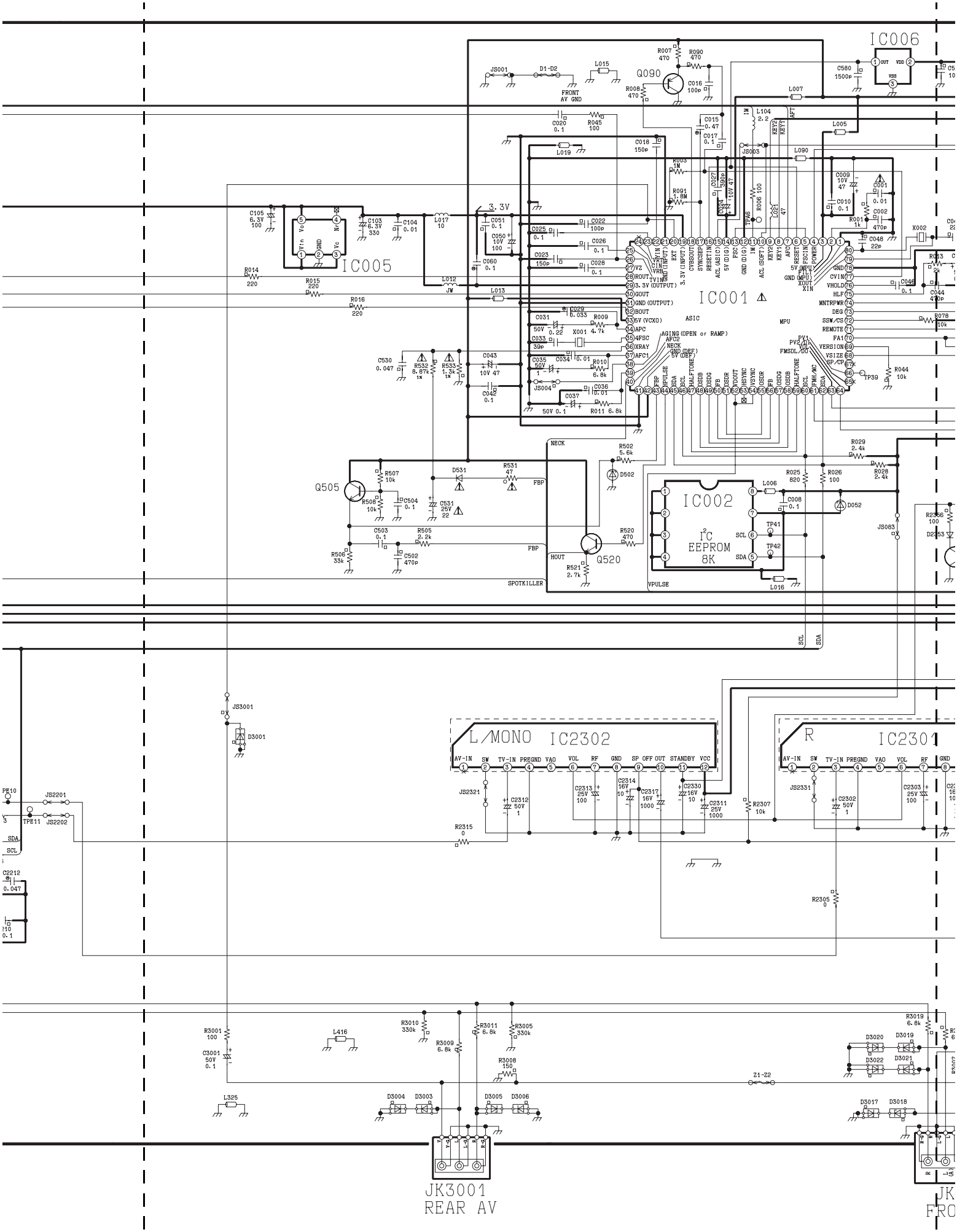
PRECAUCION: SI no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

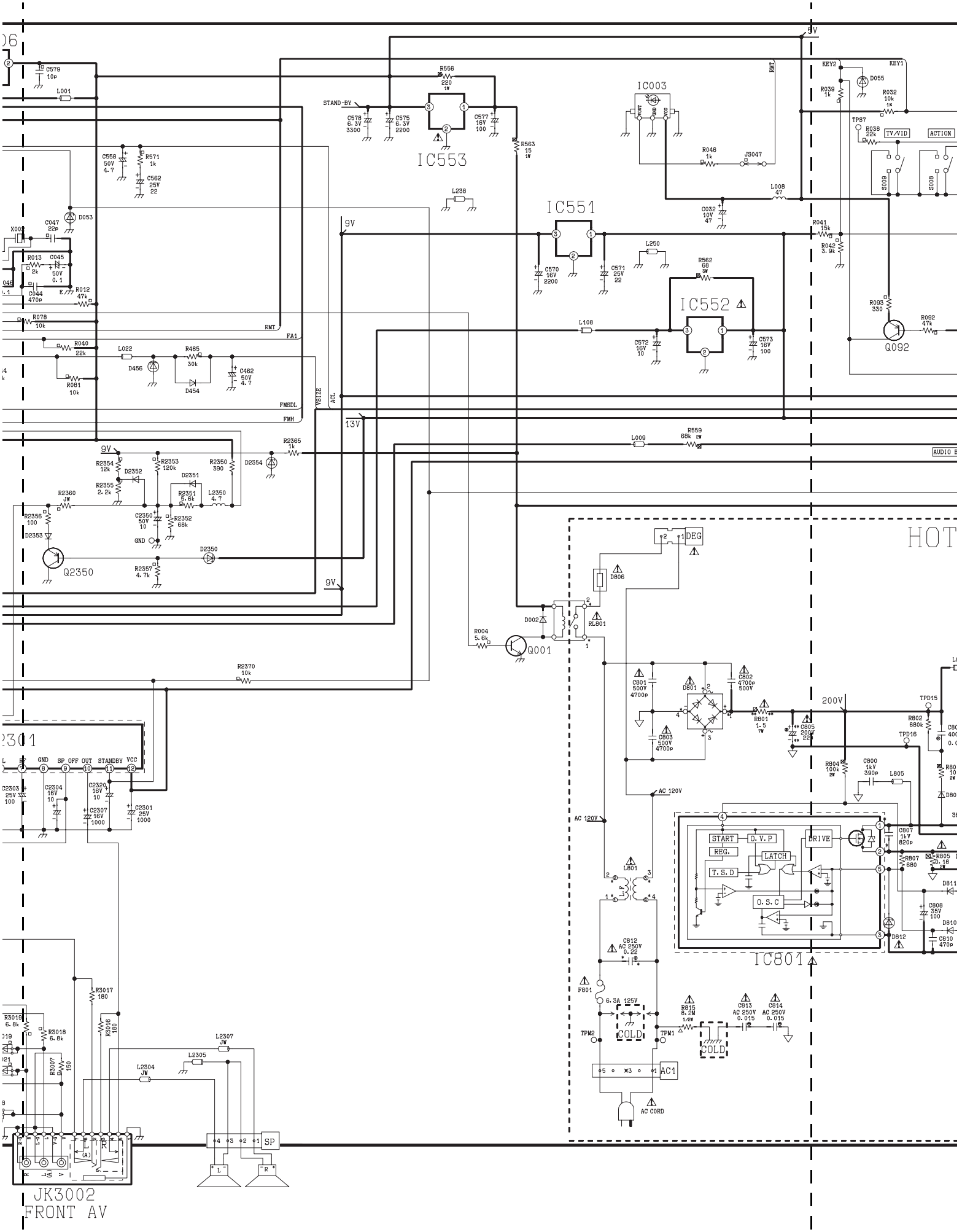
MEDICIÓN DE FORMAS DE ONDA

1. Un símbolo como ③ indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.


5V
9V
MTS
S-AGC
IC2201
Q006
Q007
Q008
R OUT
G OUT
B OUT
A11
FRONT AV GND
AFT
FMSDL
FMH
FA1
TP
TNR001
ADD 2.5V WHEN CUT OFF ADJUST
Intelligent monitor
JS021
JS2201
JS2202
JS3001
D3001
L325
TPE10
TPE11
TPA5
TPE1


IC006
IC005
IC001
ASIC
MPU
IC002
I²C EEPROM 8K
L/MONO IC2302
R IC2301
JK3001
REAR AV
3.3V
NECK
FBP
HOUT
SPOTKILLER
VPULSE
SCL
SDA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IC552
IC003
IC801
HOT
9V
13V
200V
AC 120V
STAND-BY
RMT
FA1
FMSDL
FMH
VSIZE
ACL
AUDIO B
DEG
START
O. V. P
REG.
LATCH
T. S. D
DRIVE
O. S. C
COLD
AC CORD
JK3002
FRONT AV
SP
L
R
GND
SP OFF
OUT
STANDBY
VCC
TV/VID
ACTION
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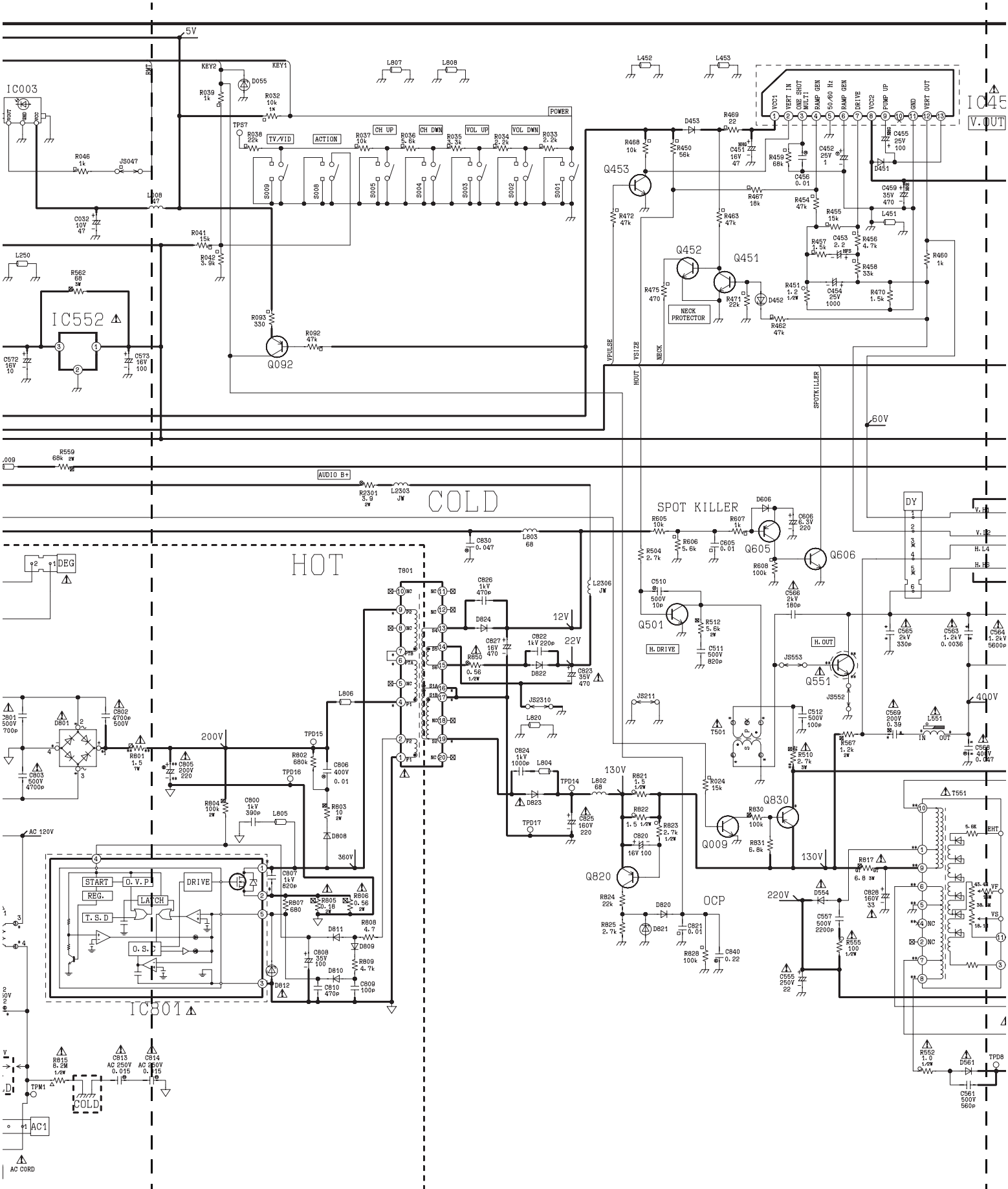
KEY2
TPS7
TPD15
TPD16
Q2350
Q001
Q092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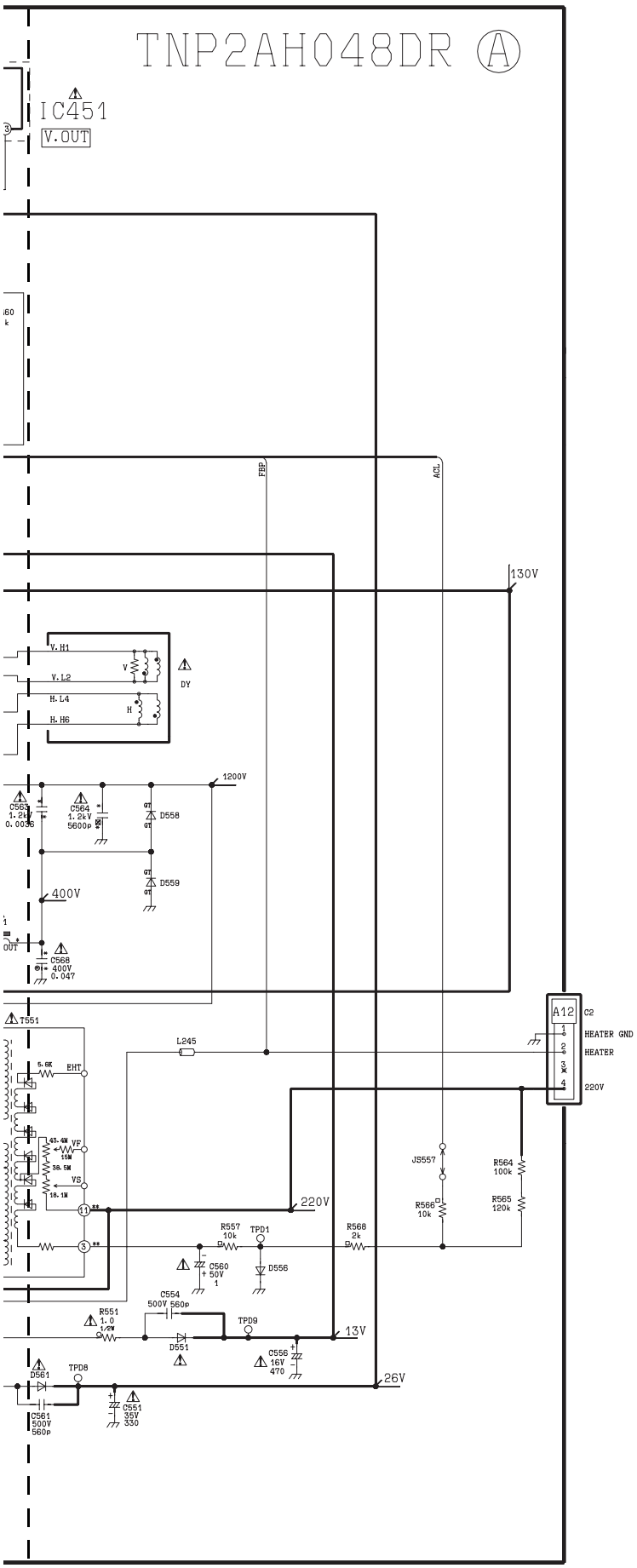
IC003
KEY2
KEY1
D055
POWER
TV/VID
ACTION
CH UP
CH DWN
VOL UP
VOL DWN
IC552
Q092
Q453
Q452
Q451
NECK PROTECTOR
IC451
V.OUT
60V
AUDIO B+
COLD
HOT
SPOT KILLER
Q605
Q606
Q501
H.DRIVE
H.OUT
Q551
DY
V.H1
V.H2
H.L4
H.H5
400V
12V
22V
200V
130V
220V
Q830
Q009
Q820
OCP
T801
T501
T551
IC801
START
O.V.P
REG.
LATCH
DRIVE
T.S.D
O.S.D
AC 120V
AC CORD
AC1
TPM1
DEG
EHT
VF
VS


TNP2AH048DR Ⓐ
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V.OUT
FBP
ACL
130V
V. H1
V. L2
H. L4
H. H6
V
H
DY
1200V
C565
1.2kV
0.0036
C564
1.2kV
5600p
D558
D559
400V
C568
400V
0.047
T551
A12
C2
HEATER GND
HEATER
220V
L245
5.6K
EHT
43.4M
VF
10M
58.5M
VS
18.1M
220V
JS557
R564
100k
R566
10k
R565
120k
R557
10k
TPD1
R568
2k
C560
+ 50V
1
D556
C554
500V 560p
R551
1.0
1/2W
TPD9
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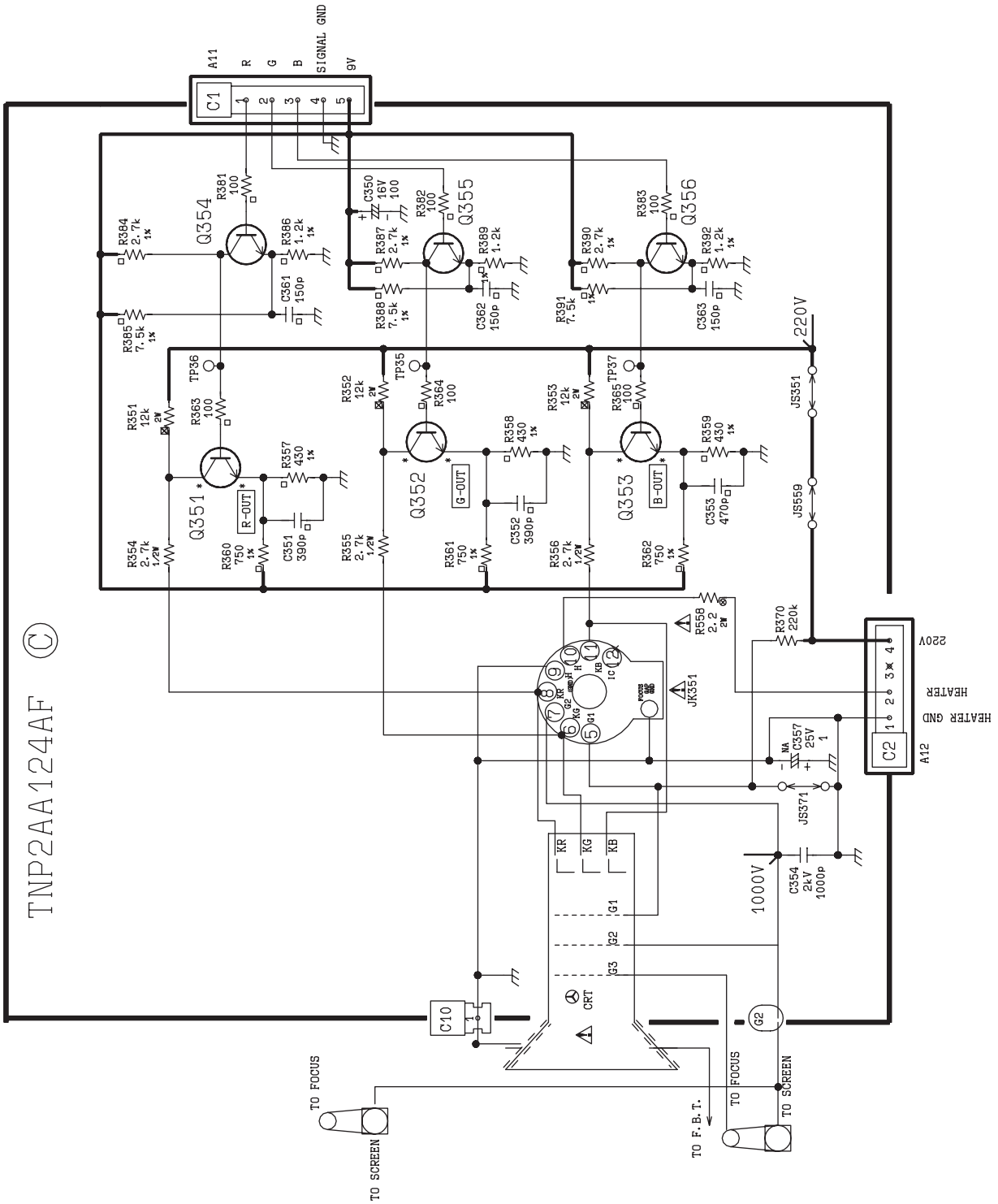
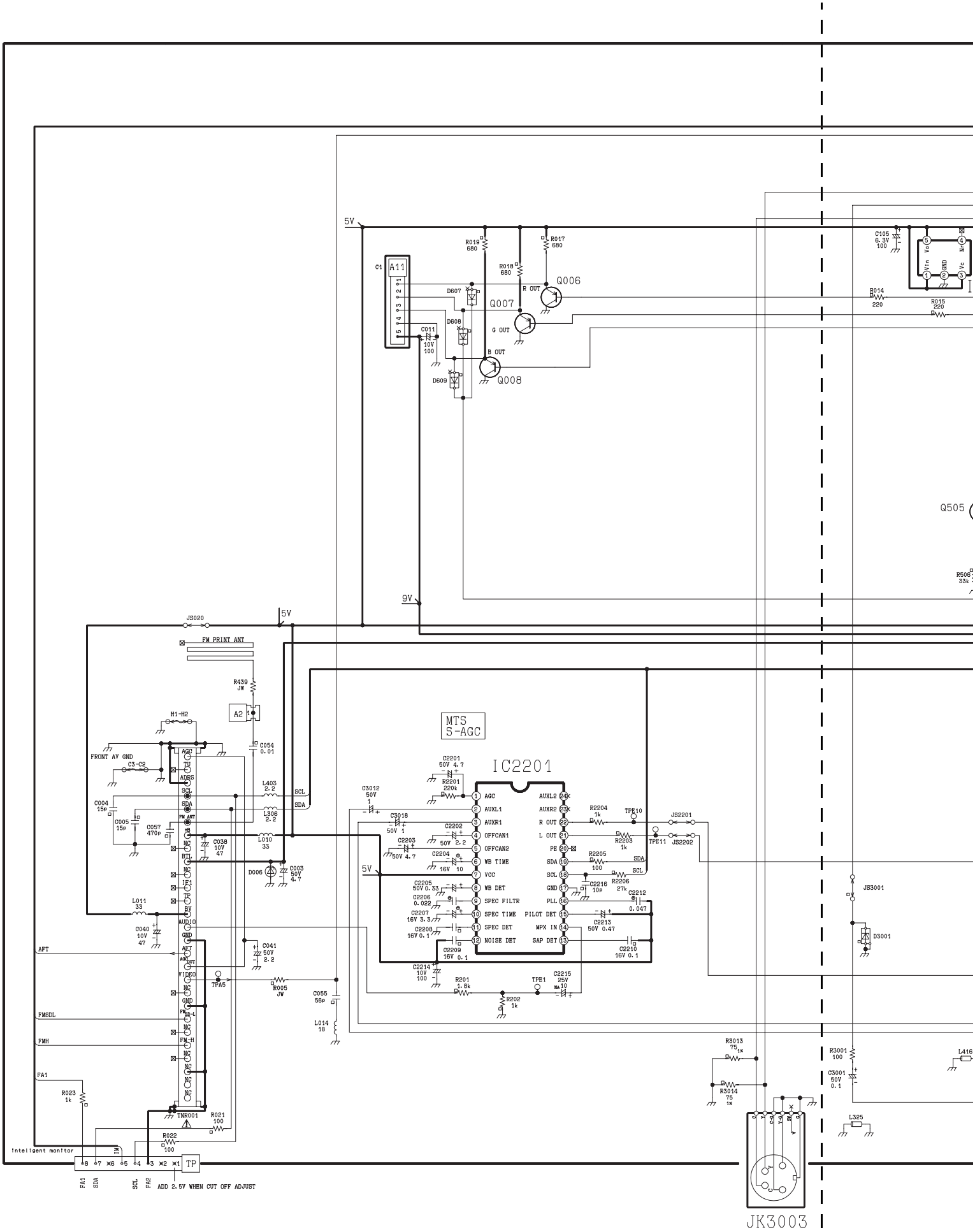
D551
C556
16V
470
D561
TPD8
26V
C561
500V
560p
C551
35V
330


TNP2AA124AF C
A11
R
G
B
SIGNAL GND
9V
C1
Q354
Q355
Q356
Q351
Q352
Q353
R381 100
R382 100
R383 100
R384 2.7k 1%
R386 1.2k 1%
R387 2.7k 1%
R389 1.2k
R390 2.7k 1%
R392 1.2k 1%
R385 7.5k 1%
R388 7.5k 1%
R391 7.5k 1%
C350 16V 100
C361 150p
C362 150p
C363 150p
TP36
TP35
TP37
R351 12k 2W
R352 12k 2W
R353 12k 2W
R363 100
R364 100
R365 100
R357 430 1%
R358 430 1%
R359 430 1%
R-OUT
G-OUT
B-OUT
C351 390p
C352 390p
C353 470p
R354 2.7k 1/2W
R355 2.7k 1/2W
R356 2.7k 1/2W
R360 750 1%
R361 750 1%
R362 750 1%
220V
JS351
JS559
R558 2.2 2W
R370 220k
JK351
C2
A12
220V
HEATER
HEATER GND
C357 NA 25V 1
JS371
KR
KG
KB
G1
G2
G3
1000V
C354 2kV 1000p
CRT
C10
G2
TO FOCUS
TO SCREEN
TO F.B.T.
TO FOCUS
TO SCREEN


5V
9V
A11
C1
R019 680
R018 680
R017 680
D607
D608
D609
Q006
Q007
Q008
R OUT
G OUT
B OUT
C011 10V 100
C105 6.3V 100
R014 220
R015 220
Q505
R506 33k
JS020
FM PRINT ANT
R439 JW
A2
H1-H2
FRONT AV GND
C3-C2
C054 0.01
L403 2.2
L306 2.2
SCL
SDA
C004 15p
C005 15p
C057 470p
C038 10V 47
L010 33
D006
C003 50V 4.7
L011 33
C040 10V 47
C041 50V 2.2
TPA5
R005 JW
C055 56p
L014 18
AFT
FMSDL
FMH
FA1
R023 1k
R021 100
R022 100
TNR001
Intelligent monitor
TP
FA1
SDA
SCL
FA2
ADD 2.5V WHEN CUT OFF ADJUST
MTS
S-AGC
IC2201
AGC
AUXL1
AUXR1
OFFCAN1
OFFCAN2
WB TIME
VCC
WB DET
SPEC FILTR
SPEC TIME
SPEC DET
NOISE DET
AUXL2
AUXR2
R OUT
L OUT
PE
SDA
SCL
GND
PLL
PILOT DET
MPX IN
SAP DET
C2201 50V 4.7
R2201 220k
C3012 50V
C3018 50V 1
C2202 50V 2.2
C2203 50V 4.7
C2204 16V 10
C2205 50V 0.33
C2206 0.022
C2207 16V 3.3
C2208 16V 0.1
C2209 16V 0.1
C2214 10V 100
R201 1.8k
R202 1k
TPE1
C2215 25V 10
R2204 1k
TPE10
JS2201
TPE11
JS2202
R2205 100
R2206 27k
C2216 10p
C2212 0.047
C2213 50V 0.47
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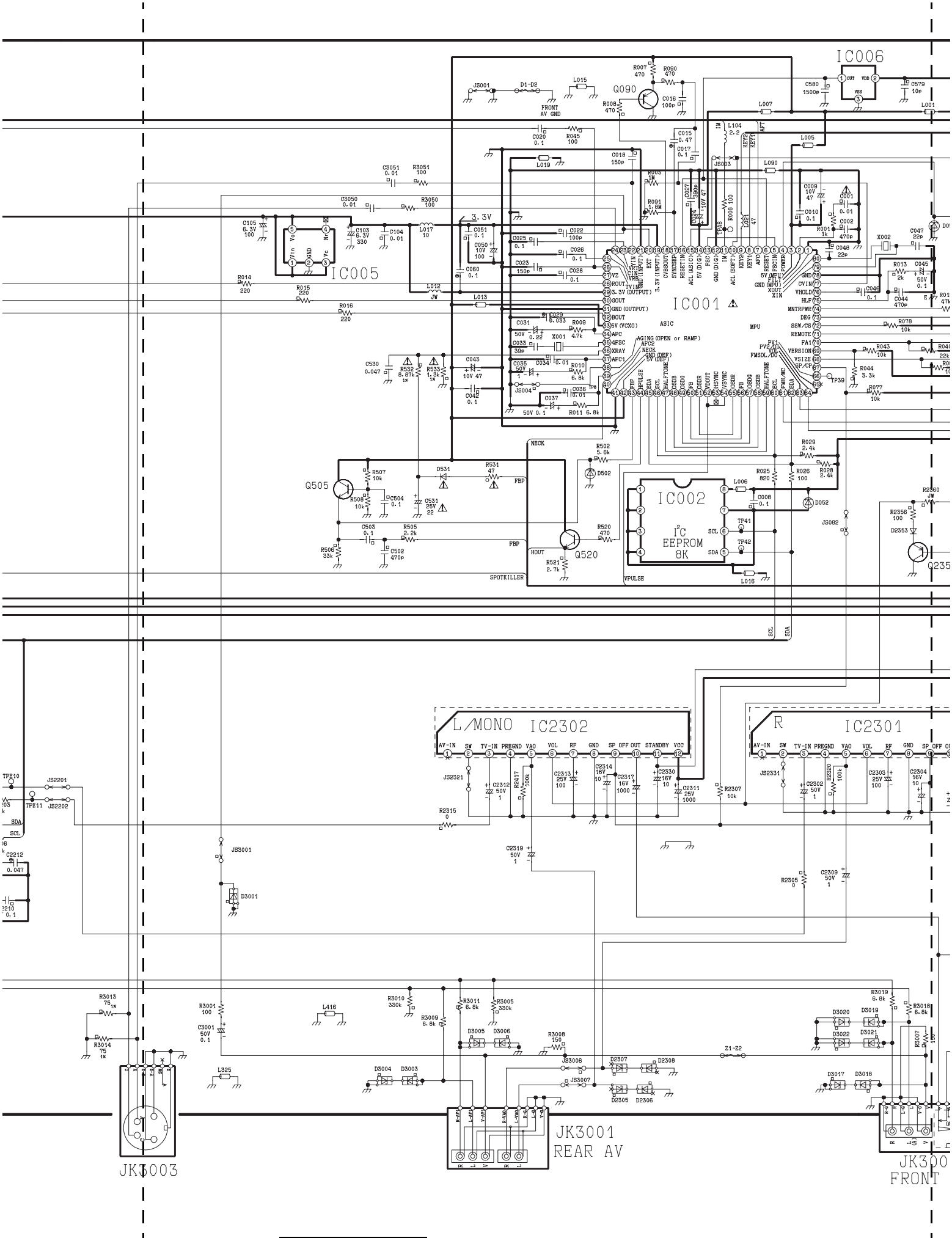
L325
L416
JK3003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IC005
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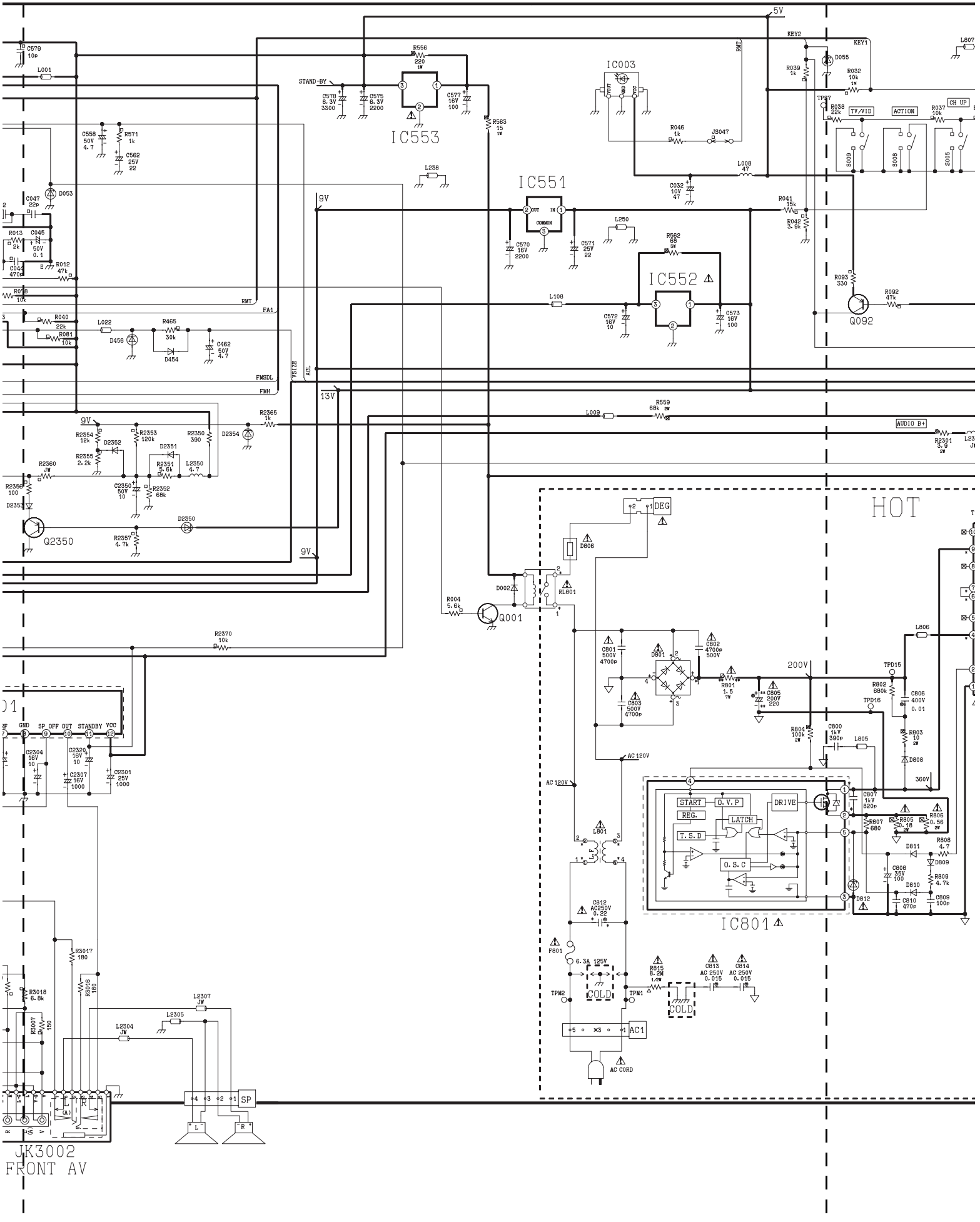
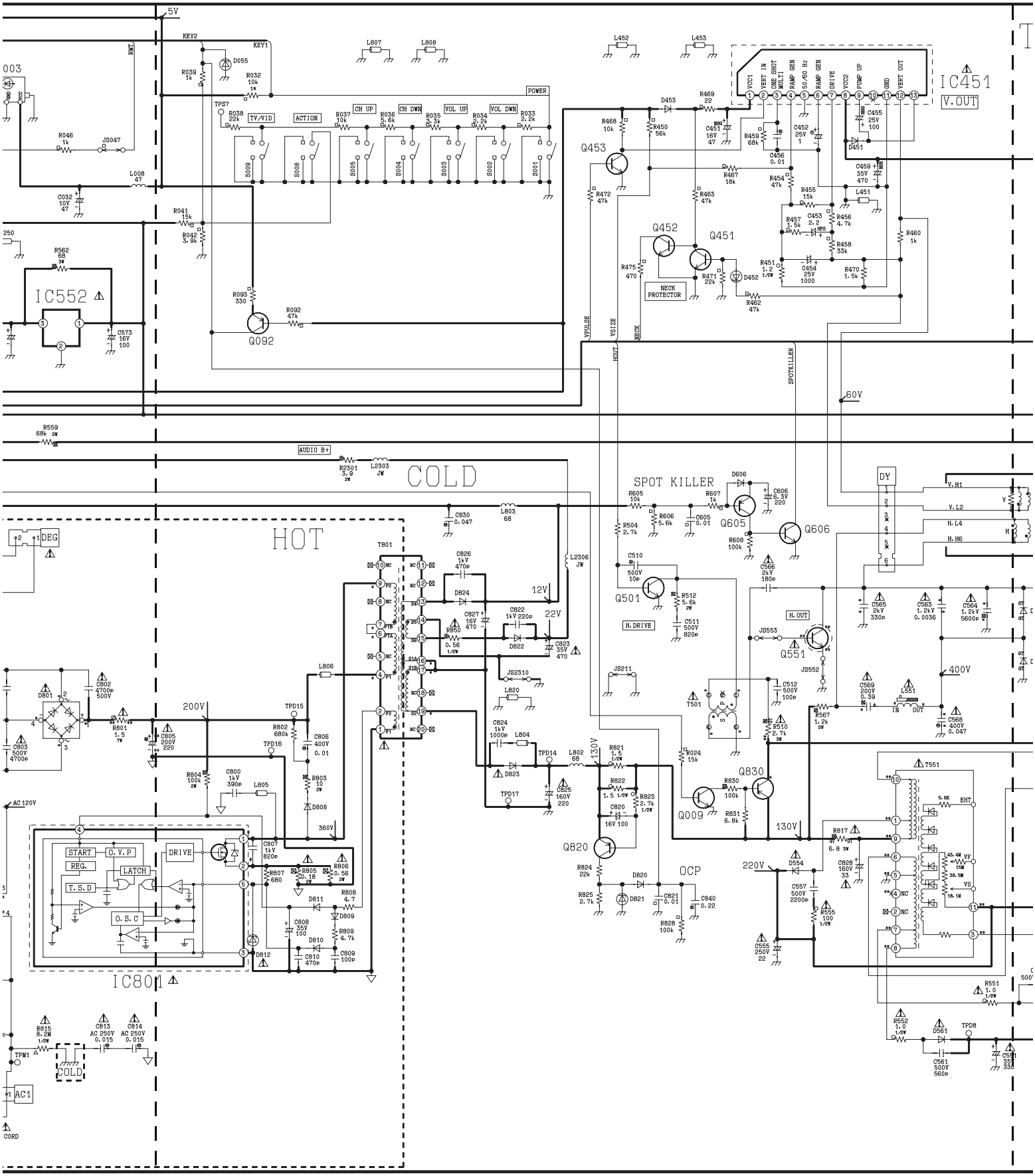
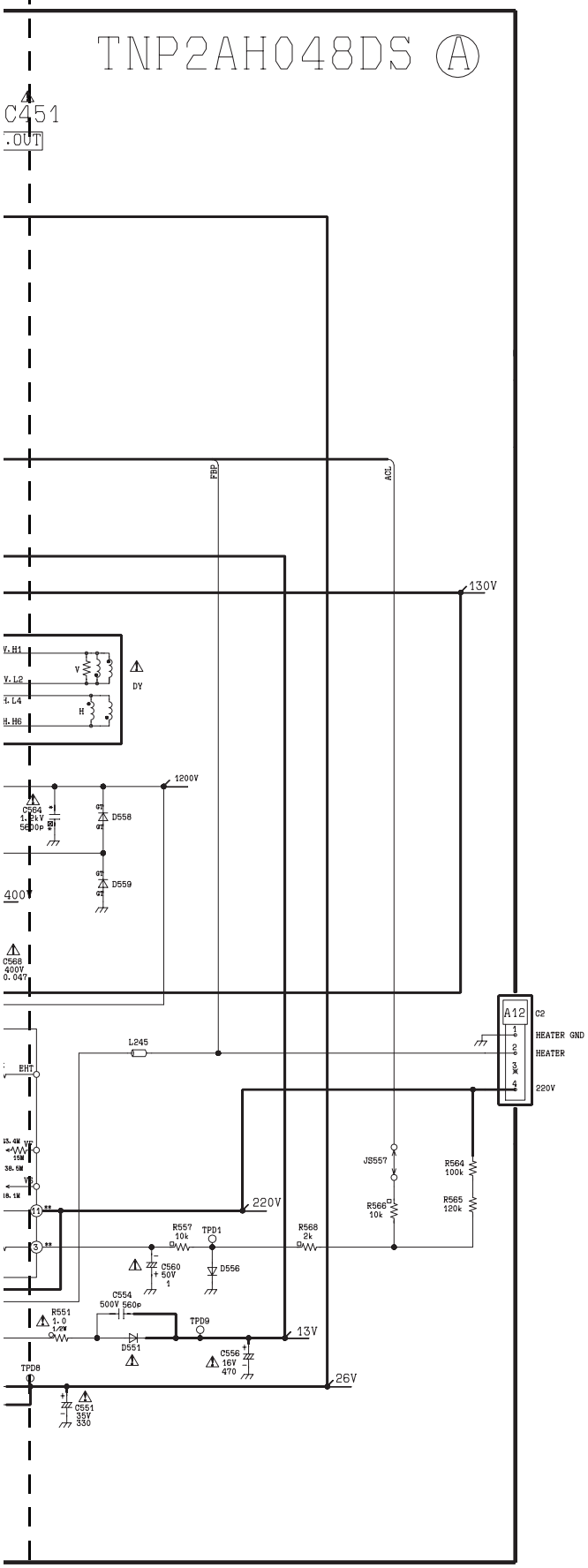
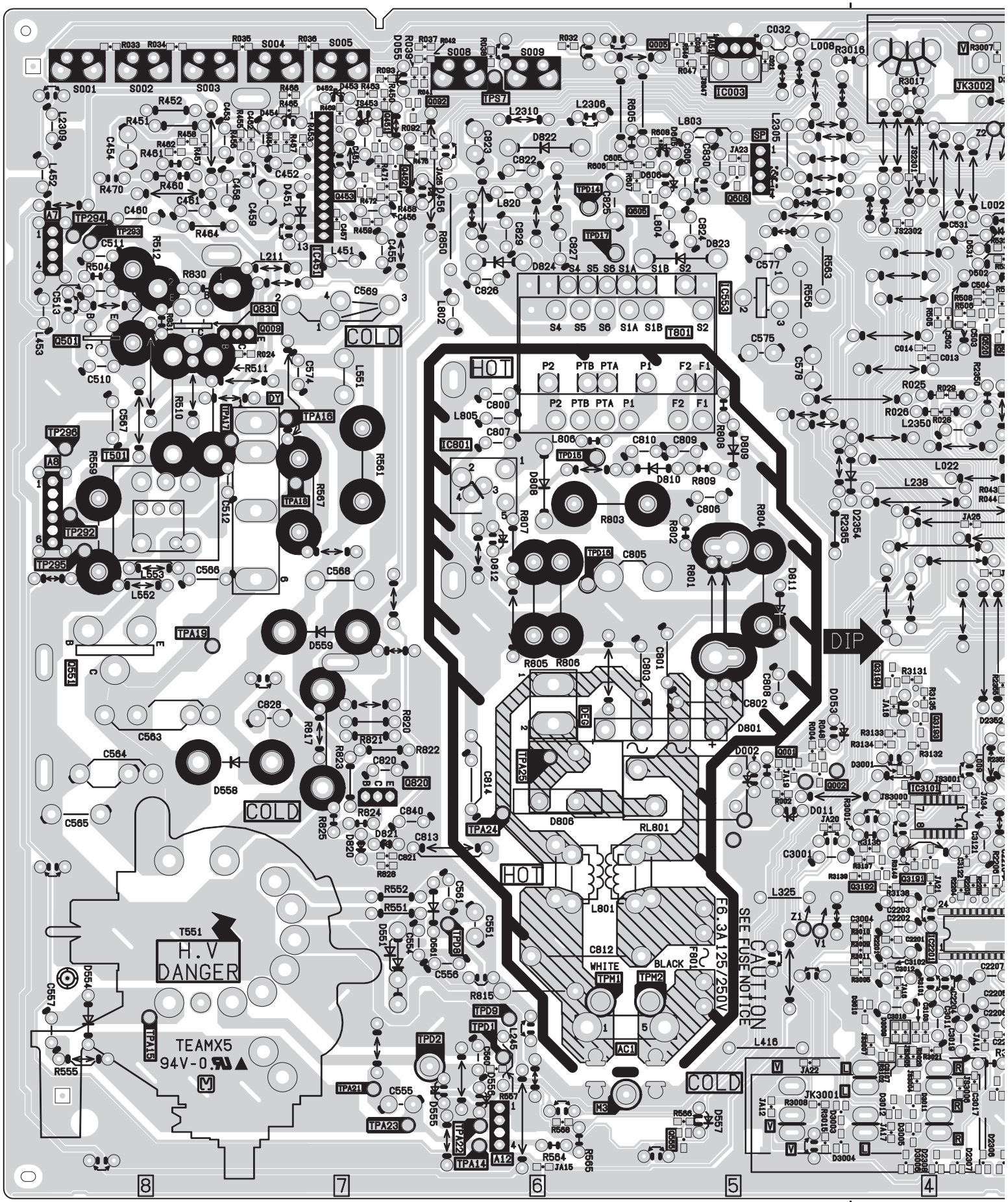
IC002
I²C EEPROM 8K
L/MONO IC2302
R IC2301
JK3003
JK3001 REAR AV
JK300 FRONT
3.3V
ASIC
MPU
NECK
SPOTKILLER
VPULSE
HOUT
FBP
SCL
SDA


IC553
IC551
IC552
IC003
IC801
HOT
Q2350
Q001
Q092
JK3002
FRONT AV
START
O.V.P
DRIVE
REG.
LATCH
T.S.D
O.S.C
COLD
COLD
AC1
AC CORD
5V
9V
13V
200V
AC 120V
STAND-BY
RMT
FMSDL
FMH
AUDIO B+
CH UP
TV/VID
ACTION
SP


5V
KEY2
KEY1
D055
POWER
CH UP
CH DWN
VOL UP
VOL DWN
TV/VID
ACTION
IC552
Q092
IC451
V.OUT
Q453
Q452
Q451
D452
NECK PROTECTOR
60V
AUDIO B+
COLD
HOT
SPOT KILLER
Q605
Q606
Q501
H.DRIVE
H.OUT
Q551
DY
Q830
Q009
Q820
OCP
IC801
START
O.V.P
REG.
LATCH
T.S.D
O.S.C
DRIVE
AC 120V
200V
360V
220V
130V
400V
12V
22V
TPM1
AC1
CORD


TNP2AH048DS Ⓐ
C451
.OUT
FBP
ADJ
130V
DY
1200V
D558
D559
400V
A12
C2
HEATER GND
HEATER
220V
L245
EHT
J8557
R564
100k
R566
10k
R565
120k
220V
R557
10k
TPD1
R568
2k
C560
+ 50V
1
D556
C554
500V 560p
R551
1.0
1/2W
TPD9
13V
D551
C556
16V
470
TPD8
26V
C551
35V
330

NOTES:


COLD
HOT
DIP
DY
T501
T551
T801
IC801
IC3101
IC003
IC553
Q820
Q830
Q501
Q009
Q551
Q552
Q553
Q606
Q005
Q002
Q001
Q453
Q452
Q092
Q603
Q604
Q605
Q607
Q608
Q609
Q610
Q611
Q612
Q613
Q614
Q615
Q616
Q617
Q618
Q619
Q620
Q621
Q622
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Q624
Q625
Q626
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Q628
Q629
Q630
Q631
Q632
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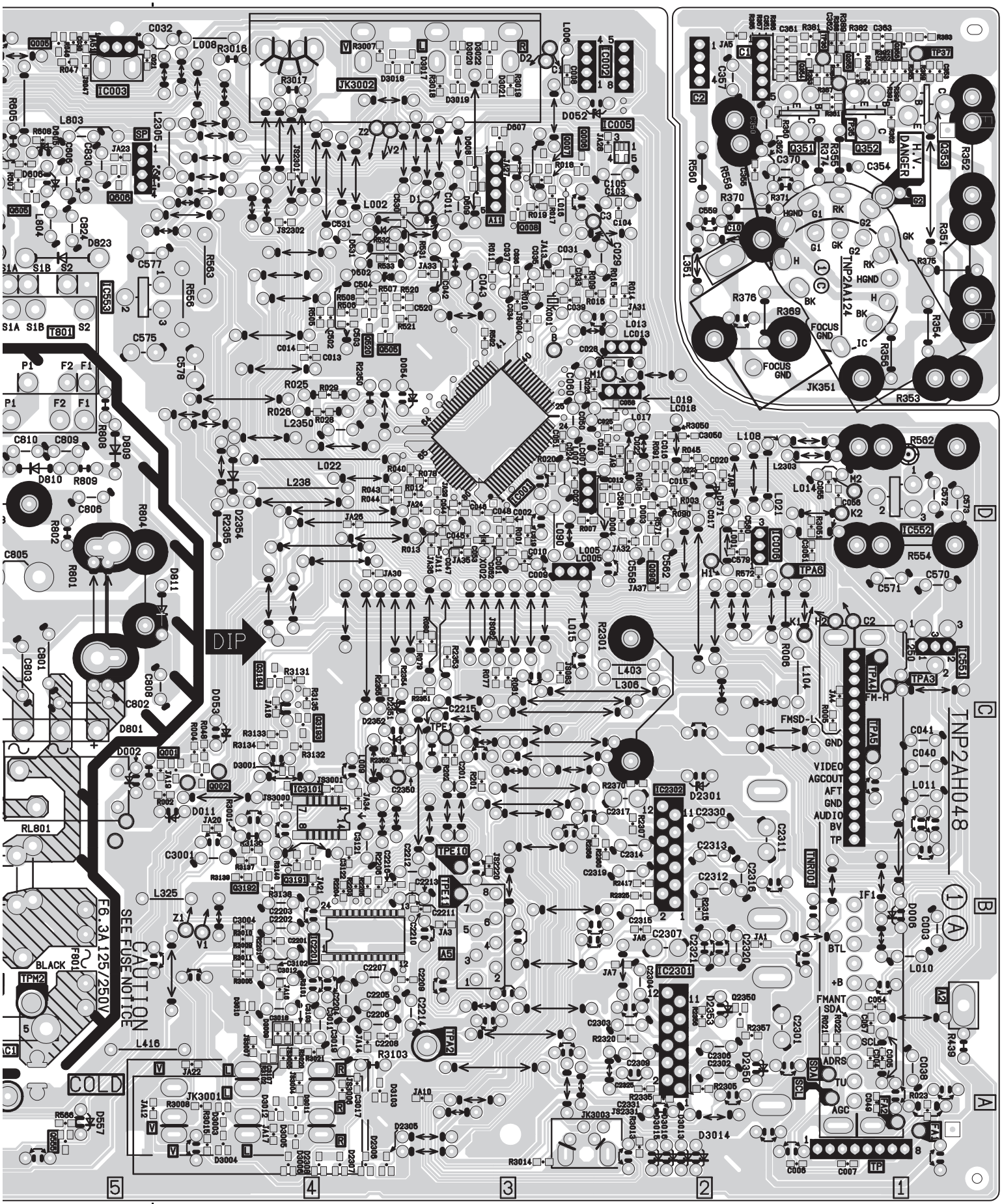
Q639
Q640
Q641
Q642
Q643
Q644
Q645
Q646


TNP2AH048
DIP
COLD
CAUTION
SEE FUSE NOTICE
F6.3A 125/250V
H.V. DANGER
TNP2AA124
FOCUS GND
FM-H
VIDEO
AGCOUT
AFT
AUDIO
BV
TP
FMSD-L
BTL
+B
FMANT
SDA
SCL
ADRS
TU
AGC
IF1
BLACK

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